Docket 87279JDP
Customer No. 01333

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of Jiebo Luo, et al METHOD OF USING TEMPORAL CONTEXT FOR IMAGE CLASSIFICATION Serial No. 10/712,181 Filed 13 November 2003	Group Art Unit: 2624 Confirmation No.: 7890 Examiner: Bernard Krasnic

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Commissioner for Patents
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Sir:

APPEAL BRIEF PURSUANT TO 37 C.F.R. 41.37 and 35 U.S.C. 134

This Appeal Brief is being resubmitted with correction of minor informalities in response to the Notice of Non-Compliant Appeal Brief dated July 17, 2009. This Appeal Brief is being submitted within one-month of the mailing date of the Notice and, therefore, no fee is due.

This appeal is from the Examiner's decision finally rejecting claims 1-6, 8, and 10-12 as set forth in the Office Action of September 11, 2009.

A timely Notice of Appeal was filed March 10, 2009.

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APPELLANT'S BRIEF ON APPEAL

Appellants hereby appeal to the Board of Patent Appeals and Interferences from the Examiner's Final Rejection of Claims 1-6, 8, and 10-12, which was contained in the Office Action mailed September 11, 2008.

A timely Notice of Appeal was filed March 10, 2009.

Real Party In Interest

The real party in interest is Eastman Kodak Company, assignee of the inventors' entire interest.

Related Appeals And Interferences

No appeals or interferences are known which will directly affect or be directly affected by or have bearing on the Board's decision in the pending appeal.

Status Of The Claims

Claims 1-6, 8, and 10-12 stand finally rejected and are the subject of this appeal.

Claims 7 and 9 stand cancelled without prejudice or disclaimer of the subject matter presented therein due to the Amendment filed April 27, 2007, which was resubmitted on May 16, 2007 in response to a Notice of Non-Compliant Amendment dated May 7, 2007.

Appendix I provides a clean, double spaced copy of the claims on appeal.

Status Of Amendments

An Amendment After Final was filed on May 11, 2009. An Advisory Action dated May 21, 2009, indicated that such Amendment After Final would not be entered for purposes of this Appeal and that the rejection of the claims would be maintained.

Summary of Claimed Subject Matter

Independent Claim 1 reads as follows. Example citations of support in the description for Claim 1's limitations are shown below in bold and in parenthesis. Such citations are not intended to be exhaustive.

Claim 1 requires a method for improving scene classification of a sequence of digital images. The method includes (a) providing a sequence of images captured in temporal succession **(page 5, lines 28-29; FIG. 1, reference numeral 10; and page 6, lines 30-32)**, at least two pairs of consecutive images **(page 6, lines 4-5)** in the sequence of images having different elapsed times between their capture **(page 6, lines 3-6; page 12, line 15 to page 13, line 3; and page 14, lines 3-14, including Table 4)**. The method also includes (b) classifying each of the images individually based on information contained in the individual image **(page 5, lines 29-32; and FIG. 1, reference numeral 20)** to generate an initial content-based image classification for each of the images **(page 5, line 32 to page 6, line 2; FIG. 1, reference numerals 30 and 40)**. In addition, the method includes (c) generating a final image classification **(page 6, lines 8-11; FIG. 1, reference numeral 90)** for each image based at least on the respective initial content-based image classification and a pre-determined temporal context model **(page 6, lines 2-3; FIG. 1, reference numerals 60 and 80)** that considers at least the temporal succession of the sequence of images **(page 5, lines 15-19)**. And, the method includes (d) storing the final image classifications in a computer readable storage medium (page 5, lines 2-9).

Grounds of Rejection to be Reviewed on Appeal

The following issues are presented for review by the Board of Patent Appeals and Interferences:

1. the propriety of the rejection of Claims 1-2, 4-5, and 12 under 35 U.S.C. 103(a) in view of "A Recurrent Neural Network Classifier for Improved Retrievals of Areal Extent of Snow Cover", Simpson et al., IEEE Transactions on Geoscience and Remote Sensing, Vol. 39, No. 10, October 2001, pages 2135-2147 (**hereinafter the "Simpson Article**") and "Automatic Image Event Segmentation and Quality Screening for Albuming Applications", Loui et al., IEEE Int'l Converence on Multimedia and Expo, July 2000, New York City, New York (**hereinafter the "Loui Article**");

2. the propriety of the rejection of Claim 3 under 35 U.S.C. 103(a) in view of the Simpson Article, the Loui Article, and U.S. Patent No. 6,977,679 (the "Tretter Patent"); and
3. the propriety of the rejection of Claims 6, 8, and 10-11 under 35 U.S.C. 103(a) in view of the Simpson Article, the Loui Article, and "Integration of Multimodal Features for Video Scene Classification based on HMM", Huang et al., IEEE Workshop on Multimedia Signal Processing, 1999, pages 53-58 (**hereinafter the "Huang Article"**).

Arguments

(1) The rejection of Claims 1-2, 4-5, and 12 under 35 U.S.C. 103(a) in view of the Simpson Article and the Loui Article

Independent Claim 1, the only independent claim, stands rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over the Simpson Article modified by the Loui Article. See pages 6-9 of the Final Office Action. Appellants respectfully request reversal of this rejection for at least the following reasons.

Claim 1 requires, among other things, two sequential image classification processes for each image in a sequence of images captured in temporal succession. The first is **an initial content-based image classification**, which is based on information contained in the individual image. The second is **a final image classification**, which is based on both the respective initial content-based image classification and a pre-determined temporal context model that considers the temporal succession of the sequence of images.

It appears that Appellants and the Examiner agree that the Simpson Article does not teach or suggest the claimed two sequential classification processes. See the page 8 of the Final Office Action, first full paragraph, which states that "Simpson fails to specifically suggest … generating a final image classification for each image based at least on the respective initial content-based image classification and a predetermined temporal context model …." In particular, the Examiner notes that the Simpson Article discloses two classification processes, FFNN and RNNCCS. See the Final Office Action, page 6, paragraph #7, lines 7-9 ("Simpson discloses a method/single image

classification using feed-forward neural networks (FFNN) and image sequence classification using recurrent neural networks (RNNCCS) ….”).

The FFNN process is understood to classify pixels of isolated scenes, such as the pixels of a single satellite image, without regard to other images. See the Simpson Article, Section III-B-(1), first paragraph (“At midlatitudes, data from a given AVHRR instrument typically are received only once per daylight period. The … [FFNN] network was designed to classify isolated scenes such as these.”). See also the Simpson Article, Section III-B-(1), third paragraph (“Each output corresponds to a class of data (X = clear, Y = cloud, Z = snow) and is trained to return a value between 0 and 1…. An output node returns zero when the network is maximally certain that a given **pixel** does not correspond to its class ….”) (bold added for emphasis). See also the Simpson Article, FIG. 3(a) with the title “No Feedback” (indicating that feedback for pixel values from a previous image is not used in the FFNN process).

On the other hand, the RNNCCS process is understood to classify pixels of images at least in part based on the value of corresponding pixels in a previous image. See the Simpson Article, Section III-B-(2), first paragraph (“GOES provides about twelve daylight scenes per day …. When such data are available, …. (RNNCCS) improves classification skill. The RNNCCS uses spectral and texture information from the current image in the time series as input, along with data from the previous texture input and the previous network output (Fig. 3(b)). This allows the network to have an operational ‘short term memory’ of both texture and classification data from the previous image.”). See also the Simpson Article, Section III-B-(2), second paragraph (“If, for example, the previous RNNCCS classification assigned pixel P as snow and the texture data for pixel P remains close to its previous value, then the RNNCCS network knows that pixel P probability still is snow.”).

Accordingly, the Simpson Article is understood to teach that if only an isolated image is available, the FFNN process is used to classify each pixel of that image. However, if a series of images is available, the pixels of the images are classified using the RNNCCS process, because it improves classification skill. See the Simpson Article, Section III-B-(2), first paragraph.

Because the Simpson Article does not teach or suggest that the FFNN and RNNCSS processes are performed on an image in sequence, one followed by the other, as would be required by Claim 1, the Examiner refers to the Loui Article.

Unlike the Simpson Article, which classifies individual pixels in an image, the Loui Article groups images based on events (e.g., trip to New York City). See the Loui Article, Abstract ("A novel event segmentation algorithm was created to automatically cluster pictures into events and sub-events for albuming, based on date/time metadata as well as color content of the pictures.")

As best shown by the steps at the top-left of page 2 ("the following steps are carried out…") and FIG. 1, the Loui Article is understood to teach running a first-level date/time clustering algorithm to determine event boundaries. See Step 1 and the "1st level" box in FIG. 1. For example, pictures captured on one day may be grouped into one event and pictures on the next day may be grouped into a separate event. See Section IV - Results and Discussion. After the date/time event clustering, a second-level clustering is performed by analyzing image content (color similarity/block-based histogram algorithm). The second-level clustering is used to verify the event boundaries (generated from the first-level clustering) and to ensure that each cluster is composed of several groups of pictures. See Steps 2 and 3 and the "2nd level" box in FIG. 1. For example, the color characteristics of the last picture taken on the first day may be compared to the color characteristics of the first picture taken on the second day to make sure the two days represent different events. See Section II.B - Block-Based Histogram Correlation, first paragraph ("If the average intersection is below a low threshold we can say that the two pictures are sufficiently different and may not be part of the same event."). After the analysis of image content to verify event boundaries and to ensure that each cluster has a proper number of groups of pictures, some of the groups are merged if the date/time separations between the groups are not meaningful. See step 4. At step 5, subject arrangement within an event is checked to group similar pictures together. Finally, at step 6, refinement is carried out to check if there are too many groups with an isolated picture, and whether some of these groups can be merged. See the "refinement" box in FIG. 1.

In order to reject Claim 1, the Examiner argues that the Loui Article's "1st level cluster events by date/time" box of FIG. 1 would obviously be replaced with the Simpson Article's RNNCCS classification, and that the "2nd level cluster events by image content" box of FIG. 1 would obviously be replaced with the Simpson Article's FFNN classification. See the Final Office Action, page 2, paragraph #3. If Appellants understand the Examiner's position correctly, the "2nd level" box of FIG. 1 is alleged to correspond to Claim 1's initial content-based classification, and the "1st level" box is alleged to correspond to Claim 1's pre-determined temporal context model. In this case, the Examiner concludes that the "refinement by split and merge" box of the Loui Article's FIG. 1 allegedly corresponds to Claim 1's final image classification.

The Examiner has the burden of establishing a prima facie case of unpatentability. Appellants respectfully submit that this burden has not been met and that one of ordinary skill in the art would not combine the teachings of the Simpson Article and the teachings of the Loui Article in the manner suggested in the Final Office Action.

In particular, the teachings of the Simpson Article and the Loui Article are incompatible and teach away from each other. And, even if they were compatible, results would be unpredictable.

a. The Simpson Article and the Loui Article Serve Different Functions: One Classifies Pixels and the Other Groups Whole Images

As discussed earlier, the Simpson Article is understood to teach that its FFNN and RNNCCS classification processes each output a pixel-by-pixel classification for each image input. See the Simpson Article, Section III-B, third paragraph, and FIGS. 3(a) and 3(b). The Loui Article, on the other hand, is directed to grouping whole images together based on event similarities. In other words, the RNNCCS and FFNN processes serve the function of classifying pixels within an image, and the Loui Article's clustering serves a different function of grouping images. Accordingly, the Loui Article's event clustering is not suited to handle pixel-by-pixel classifications as its 1st and 2nd level clustering steps. Such

incompatibility would lead one of ordinary skill in the art away from combining the articles in the manner suggested.

b. The Simpson Article's FFNN and RNNCCS Processes Do Not Build From One Another, as Required by the Loui Article

The Loui Article's 2nd level clustering of events by image content is understood to build from initial event clusters generated by the 1st level clustering by date/time. See the dotted line from the "1st level" box to the "2nd level" box in FIG. 1 of the Loui Article. See also steps 2 and 3 at the upper-left of page 2 of the Loui Article (presupposing that event boundaries and clusters already exist when performing the 2nd level clustering). How or why would one of ordinary skill in the art use the FFNN process of the Simpson Article to build from output from the RNNCCS process. First, the RNNCCS process is not understood to generate event clusters to be revised by a 2nd level clustering according to the Loui Article. Second, even assuming for argument's sake that the Loui Article was directed to pixel-wise classifications, the FFNN process is described by the Simpson Article as using no feedback. See FIG. 3(a) of the Simpson Article titled "No Feedback". FFNN is taught to be a stand-alone process that does not build from prior classifications. See the Simpson Article, Section III-B, first paragraph ("The … [FFNN] network was designed to classify isolated scenes ….") By definition, then, the FFNN process does not build from prior output. Accordingly, it is respectfully submitted that one of ordinary skill in the art would look away from using the FFNN process of the Simpson Article as the Loui Article's 2nd level clustering.

c. No Benefit Exists for Using the RNNCCS and FFNN Processes as the Loui Article's 1st and 2nd Level Event Clustering

No benefit appears to be gained by using the RNNCCS process as the Loui Article's 1st level clustering and the FFNN process as the 2nd level clustering. In particular, the Loui Article is described as operating on a plurality of pictures. See "input pictures" on the left-hand side of FIG. 1 of the Loui Article. If multiple pictures are available, why would the FFNN process, directed

to isolated images, be used at all? The Simpson Article is understood to state that the RNNCCS process produces a better classification result than the FFNN process when a sequence of images is available. See the Simpson Article, Section III-B-(2), first paragraph. Consequently, the Simpson Article is understood to teach that only the RNNCCS process would be used when a sequence of images is available. See the Simpson Article, Section III-B-(2), first paragraph, and Section III-B-(1), first paragraph. It appears that in the case of executing both the FFNN process and the RNNCCS process on the same sequence of images, results of the FFNN process would be wasted, because they are redundant and inferior to the results of the RNNCCS process. Accordingly, Appellants respectfully submit that the Simpson Article teaches away from using both of the FFNN and RNNCCS processes on a sequence of images.

d. The Loui Article's Refinement Step is Incompatible with Outputs of the Simpson Article's FFNN and RNNCCS Processes

The Loui Article describes that its refinement step "is carried out to check if there are too many groups with an isolated picture, and whether some of them can be merged." See step 6, upper-left of page 2, and the "refinement" box in FIG. 1 of the Loui Article. As far as can be imagined, if RNNCCS were used as the 1st level clustering, and FFNN were used as the 2nd level clustering of the Loui Article, the input to the refinement box in FIG. 1 would be a plurality of images each having its pixels classified (e.g., clear, cloud, or snow). However, the refinement step of the Loui Article is looking for groups of images having an isolated image. Consequently, the refinement step of the Loui Article seems incompatible with the outputs provided by the RNNCCS and FFNN processes. Why or how would one of ordinary skill in the art feed dueling pixel-by-pixel comparisons from RNNCCS and FFNN into the Loui Article's refinement step, which looks for groups of images having isolated images? Appellants respectfully submit that one of ordinary skill in the art would look away from the RNNCCS and FFNN processes of the Simpson Article for use as the 1st and 2nd level event clustering of the Loui Article.

Further in this regard, it appears that the Examiner may be inadvertently changing the function of the Loui Article's refinement step. The Examiner asserts that it would be obvious to have the FFNN and RNNCCS "processes run in parallel in order to act as the two inputs to Loui's refined image classification block … in order to combine the content image data and contextual image time data into the refined event classification …." See the Final Office Action, page 3, top (citing the Loui Article, FIG. 1, Section I, paragraph 1, lines 20-24). This citation to the Loui Article, however, is not directed to the function of the Loui Article's refinement step. The Loui Article explicitly states that its "refinement is carried out to check if there are too many groups with an isolated picture, and whether some of them can be merged." See the Loui Article, page 2, top-left, step 6. The Loui Article does not state that its refinement step combines content image data and contextual image time data into a refined event classification. Such a description of refinement apparently does not come from the Loui Article, the Simpson Article, or any other piece of prior art, but appears to come from the language of Claim 1 itself ("generating a final image classification for each image based at least on the respective initial content-based image classification and a pre-determined temporal context model ….").

e. Conclusion

For at least these reasons, Appellants respectfully submit that the teachings of the Simpson Article and the Loui Article are incompatible and teach away from each other. And even if they were compatible, results would be unpredictable. Appellants respectfully submit that the Examiner's burden of establishing a prima facie case of unpatentability has not been met and respectfully request reversal of the rejection of Claim 1.

Claims 2, 4-5, and 12 depend directly or indirectly from Claim 1. The combination of the Simpson Article and the Loui Article is necessary to sustain the rejections of these claims. Since such combination is submitted to be improper at least for the reasons set forth above, reversal of the rejections of these claims also is requested.

(2) The rejection of Claim 3 under 35 U.S.C. 103(a) in view of the Simpson Article, the Loui Article and the Tretter Patent

Claim 3 depends from Claim 1. The combination of the Simpson Article and the Loui Article is necessary to sustain the rejection of this claim. Since such combination is submitted to be improper at least for the reasons set forth above, reversal of the rejection of this claim also is requested.

(3) The rejection of Claims 6, 8, and 10-11 under 35 U.S.C. 103(a) in view of the Simpson Article, the Loui Article and the Hung Article

Claims 6, 8, and 10-11 depend directly or indirectly from Claim 1. The combination of the Simpson Article and the Loui Article is necessary to sustain the rejections of these claims. Since such combination is submitted to be improper at least for the reasons set forth above, reversal of the rejections of these claims also is requested.

Respectfully submitted,

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Appendix I - Claims on Appeal

1. (Previously Presented) A method for improving scene classification of a sequence of digital images comprising the steps of:

(a) providing a sequence of images captured in temporal succession, at least two pairs of consecutive images in the sequence of images having different elapsed times between their capture;

(b) classifying each of the images individually based on information contained in the individual image to generate an initial content-based image classification for each of the images;

(c) generating a final image classification for each image based at least on the respective initial content-based image classification and a pre-determined temporal context model that considers at least the temporal succession of the sequence of images; and

(d) storing the final image classifications in a computer readable storage medium.

2. (Original) The method as claimed in claim 1 wherein the information used in step (b) includes pixel information.

3. (Original) The method as claimed in claim 1 wherein the information used in step (b) includes capture-device-generated metadata information.

4. (Original) The method as claimed in claim 1 wherein the pre-determined temporal context model in step (c) is independent of elapsed time between consecutive images.

5. (Previously Presented) The method as claimed in claim 1 wherein the pre-determined temporal context model in step (c) is dependent on elapsed time between consecutive images in the sequence.

6. (Original) The method as claimed in claim 1 wherein the pre-determined temporal context model is a causal Hidden Markov Model dependent on a previous image.

7. (Cancelled)

8. (Original) The method as claimed in claim 1 wherein the pre-determined temporal context model is a non-casual model dependent on both a previous image and a subsequent image.

9. (Cancelled)

10. (Original) The method as claimed in claim 1 wherein the temporal context model is imposed using Viterbi algorithm.

11. (Original) The method as claimed in claim 1 wherein the temporal context model is imposed using a belief propagation algorithm.

12. (Previously Presented) The method as claimed in claim 1 wherein the pre-determined temporal context model in step (c) is dependent on elapsed time between consecutive images in the sequence, such that different elapsed times between a particular pair of consecutive images produces a different revised image classification for a later-captured image of the particular pair of consecutive images.

<u>Appendix II - Evidence</u>

NONE

Appendix III – Related Proceedings

NONE